VIII. COST-EFFECTIVENESS ANALYSIS

The intent of this rulemaking is to minimize risks caused by air bags to out-of-position occupants, and to enhance the overall benefits provided to occupants in most crashes. To achieve these goals, NHTSA is proposing to establish test procedures that broaden the scope of the current standard to ensure that occupants of various sizes and ages are properly protected under a variety of crash circumstances.

Four vehicle crash tests are proposed to enhance air bag benefits. Two of these tests, the oblique and frontal barrier tests, duplicate the frontal barrier tests that pre-MY1998 vehicles were required to meet, but specify a range of 18-30 mph for unbelted tests and up to 30 mph for belted tests. The range of speeds for the unbelted test is proposed to minimize the possibility that vehicles would be redesigned with lower deployment thresholds. The third test is a restrained 25 mph offset deformable barrier test with 5th percentile female belted dummies, which has been added to simulate the circumstances of an out-of-position occupant in an offset crash and measure crash sensing capabilities at lower speeds. The fourth new test is an alternative offset test for unbelted occupants at 22-35 mph that would be performed with both 50th male and 5th female dummies. This test may result in improved occupant compartment integrity. Methods for meeting the frontal barrier, offset, and oblique tests include multi-stage inflators, improved sensors, modified air bag designs and improvements in structural integrity.

The current analysis examines two alternative groupings of these tests. These groupings are summarized in Table VIII-A The reader is also referred to Figures I-2 and I-3 in Chapter 1.

Table VIII-A
Summary of High Speed Test Requirements for Alternative 1 and Alternative 2

TYPE	SPEED	BELT	DUMMY	ALT 1	ALT 2
Frontal Rigid Barrier	0-30mph	Belted	50th Male	X	X
Frontal Rigid Barrier	0-30mph	Belted	5th Female	X	X
Frontal Rigid Barrier	18-30mph	Unbelted	50th Male	X	
Frontal Rigid Barrier	18-30mph	Unbelted	5th Female	X	
Oblique Rigid Barrier	0-30mph	Belted	50th Male	X	X
Oblique Rigid Barrier	18-30mph	Unbelted	50th Male	X	
Offset Barrier	0-25mph	Belted	5th Female	X	X
Offset Barrier	22-35mph	Unbelted	50th Male		X
Offset Barrier	22-35mph	Unbelted	5th Female		X

Within each alternative grouping, all of these tests must be passed in order to prove compliance with the proposed requirements to enhance the performance of air bags.

In addition to these new tests, NHTSA is proposing to upgrade the injury criteria for the existing

frontal barrier tests by changing the way head injuries are measured, reducing allowable chest deflection, and including a measure of neck injury. NHTSA is further proposing to eliminate the sled test alternative to the barrier test.

The risk of injury from air bags arises when occupants are too close to the air bag when it inflates. Generally, those most at risk from injury are infants, children, and small stature adults. To address these concerns, tests are proposed which employ crash dummies representing infants, 3-year olds, 6-year olds, and 5th percentile female drivers. A variety of tests are proposed to protect these at-risk occupants. Manufacturers must certify compliance with one of these individual tests for each risk group (infants, children (represented by both 3 and 6 year old dummies), out-of-position drivers). The options for each risk group are summarized in Figure I-1 of this analysis.

As a practical matter then, manufacturers will have to take measures which will assure they can pass the tests designed to enhance air bag safety plus some combination of tests that address the four representative categories of occupants at risk from air bag injuries. For this analysis, these groups of possible solutions will be referred to as "compliance options". Two groups of compliance options have been identified from the basic test proposals for each Alternative. A basic assumption defining these compliance options is that, where possible, manufacturers would use the same systems to address testing for all risk groups. Thus, for example, multi-stage inflators would provide benefits for all occupants, regardless of age. However, infants would probably not be covered by multi-stage inflators without the use of a RFCSS detection sensor

because the proposal requires rear facing child safety seats to meet a separate low risk deployment test for all inflation levels up to 40 mph. It is thus likely that some form of suppression technology will be required to pass the requirements for infants.

As noted above, compliance with the new tests intended to enhance air bag benefits would be mandatory. Both compliance options include the low speed 5th percentile female dummy offset barrier test and the enhanced criteria frontal barrier tests. A number of technological solutions would enable manufacturers to meet these tests, including added sensors and multi-stage inflators, but manufacturers may meet the enhanced criteria frontal barrier tests with modified air bag designs. NHTSA is seeking public comment on the portion of the vehicle fleet that currently could meet these standards, as well as what changes would be required to assure compliance for those vehicles that do not meet these requirements.

The two optional tests potentially cover different low speed at-risk groups. The test for suppression with child presence (test reference #1 in Tables VIII-1 through VIII-12) can be conducted using the infant, 3 year old, and 6 year old dummies and thus addresses at-risk infants and children. The low-risk deployment test (test ref. #2) could be used to certify compliance for all risk groups. However, at this time the agency does not believe that an infant dummy in a RFCSS could pass the criteria with a low-risk air bag. Thus, a weight sensor has been added to this compliance option. In the NPRM, NHTSA also discussed a dynamic out-of-position test which was conducted using dummies representing all groups except infants. However, this test has been excluded from the SNPRM analysis because it requires manufacturers to file a separate

petition proposing specific test procedures for accessing their particular dynamic system. Thus, the suppression test covers both infants and non-infant children, and the low risk deployment test covers all categories except infants. The two compliance options examined here represent all logical combinations of these tests that would prove compliance for all basic at-risk groups.

The first compliance option assumes a scenario in which manufacturers meet requirements for out-of-position drivers with low risk deployment (Test ref. #2). For passengers, including infants, weight sensors are assumed (Test #1). Incremental costs for this compliance scenario range from $21 to $127. The range reflects different cost estimates provided by manufacturers or engineering tear-down studies, as well as different approaches to system design. Detailed discussion of the sources for cost estimates for technologies that determine this range as well as for cost ranges associated with other compliance options is included in Chapter VII.

The second compliance option assumes that manufacturers use a weight sensor costing $20.50 to $24.45 for infants and meet all other out-of-position requirements by meeting the low risk deployment test (Test #2). Technological solutions which could enable manufacturers to pass the low-risk test include modified air bag fold patterns and/or inflators, and multi-stage inflators. Cost estimates for meeting the low-risk test range from $0.00 to $40.80. The total cost estimate for this option ranges from $24 to $68.

In Table VIII-1, a range of cost estimates has been developed for each technology solution grouped under each proposed test option. At the bottom of Table VIII-1, these costs are

summarized for each of the compliance options discussed above. This analysis reveals potential compliance costs ranging from about $21 to $127 per vehicle. The variation in cost is a function of both the technologies used and variation in cost estimates from different sources.

As discussed in Chapter VII, some of the compliance options may result in a significant savings in property damage costs because they prevent unnecessary air bag deployments which result in replacement costs for the air bag and often destroy front windshields as well. Estimates of these savings are summarized in Table VIII-2. Note that the range of estimates in this table match the technologies used to derive the range of high and low costs from Table VIII-1, and are not necessarily the highest and lowest possible property damage impacts. This linkage to the range of costs on Table VIII-1 is necessary in order to assure that costs and benefits are consistently associated with the same vehicle changes.

In Table VIII-3, the costs from Table VIII-1 are combined with the present discounted value of property damage savings from Table VIII-2 to produce the net cost or monetary benefit from each technology and compliance option. The results indicate that compliance option 2 under both alternatives has potential property damage savings that could exceed the consumer's cost for changes needed to comply with the proposed tests.

In Table VIII-4, the net per-vehicle costs from Table VIII-3 are multiplied by 15,500,000, the estimated annual steady state sales of passenger cars and LTVs (see Chapter VII), to produce an estimate of the total annual net consumer costs of the proposed new testing requirements.

Estimates range from a cost of $653 million to a net savings of $303 million.

In Chapter V, safety benefits are derived for each proposed test procedure. These benefits are summarized in Tables V-31 through V-36. In Tables VIII-5 and VIII-7, those benefits are summarized for the technologies and compliance options used in the previous tables. As with Table VIII-2, the range is defined by the high and low estimates of costs in Table VIII-1, with the range of benefits maximized for those cases where more than one technology had the same cost. Note that in many cases, different technologies are addressing the same problem, but that some address larger target populations. To the extent that these technologies are combined under a specific compliance option, their benefits are thus not additive, and the maximum benefit for that compliance option is defined by the system with the largest safety benefit. For example, under Alternative 1, Compliance Option #2, the high range driver costs included the multi-stage inflators for the low risk deployment test, the frontal barrier test, and the 25mph offset barrier test. However, the 66 lives saved by multi-stage inflators for the 25 mph offset barrier test encompass those that would be saved by the similar equipment installed to meet the other tests. Therefore, the potential benefit from multi-stage inflators are only counted once.

In Tables VIII-6 and VIII-8, the safety benefits from Tables VIII-5 and VIII-7 have been discounted at a 7 percent rate to express their present value. Seven percent is used because it is the rate required for use in Regulatory Evaluations by the Office of Management and Budget (OMB Circular A-94, 10/29/92). The resulting estimates indicate a potential of between 116 and 167 lives saved and between 354 and 510 serious nonfatal (MAIS 2-5) injuries prevented annually after discounting.

As a primary measure of the impact of these proposals, this analysis will measure the cost per fatality, or fatality equivalent saved. In order to calculate a cost per equivalent fatality, nonfatal injuries must be expressed in terms of fatalities. This is done by comparing the value of preventing nonfatal injuries to the value of preventing a fatality. Comprehensive values, which include both economic impacts and lost quality (or value) of life considerations will be used to determine the relative value of fatalities and nonfatal injuries. These values were taken from the most recent study published by NHTSA[1]. In Table VIII, the process of converting nonfatal injuries is illustrated. The upper part of Table VIII-9 shows the comprehensive values used for each injury severity level, as well as the relative incidence-based weights for two groups of nonfatal injuries, MAIS 2-5 and MAIS 3-5. These are the 2 groupings of injuries measured for the safety enhancement test procedures and the at-risk test procedures respectively. The table shows that an average MAIS 2-5 injury is the equivalent of 0.10 fatalities, and that an average MAIS 3-5 injury is the equivalent of 0.22 fatalities.

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[1]Blincoe, L.J., The Economic Cost of Motor Vehicle Crashes, 1994, Washington D.C., DOT HS 808 425, July 1996

Because safety benefits are composed of differing portions of these groups for each occupant category within each compliance option, an average impact must be calculated for each separate category. The lower left portion of Table VIII-9 shows the portion of nonfatal injury benefits that are associated with the at-risk group for each occupant category under each compliance option. These portions (Pr) were used to weight the MAIS 3-5 injury equivalent (0.22). The remaining weight (i.e., 1- Pr), were used to weight the MAIS 2-5 injury equivalent (0.10). The results are shown in the lower right portion of Table VIII-9.

In Table VIII-10, the discounted annual nonfatal injuries from Table VIII-8 were multiplied by the factors shown in the lower right of Table VIII-9 to produce estimates of the total discounted fatal equivalents represented by nonfatal injuries. In Table VIII-11, these fatal equivalents are added to the discounted annual fatalities prevented from Table VIII-6 to produce the total fatal equivalents from both fatalities and injuries. The results indicate that from 167 to 241 fatal equivalents might be prevented by advanced air bag systems.

In Table VIII-12, the total annual costs from Table VIII-4 are divided by the discounted fatal equivalents from Table of VIII-11 to produce estimates of the net cost (or savings) per fatality saved for each compliance option. The results indicate a range from a net savings of $1.3 million to a net cost of $2.7 million per equivalent fatality saved.

Following is an example of the calculations that produced the estimate for the low end costs for Alternative 1, Compliance Option #1:

$20.50	compliance cost (Table VIII-1)
- $12.15	property damage savings (Table VIII-2)
$8.35	net cost (Table VIII-3)
x 15.5	million vehicles
$129.4	million (Table VIII-4)
161	lives saved (Table VIII-5)
x 0.72	(discounted to present value using a 7% discount rate)
116	lives saved (Table VIII-6)
491	nonfatal injuries prevented (Table VIII-7)
x 0.72	(discounted to present value using a 7% discount rate)
354	nonfatal injuries prevented (Table VIII-8)

Passengers:
197 nonfatal injuries prevented (Table VIII-8) x .1652 factor (Table VIII-9) = 32.5 fatal equivalents.

Drivers:
157 nonfatal injuries prevented (Table VIII-8) x .1161 factor (Table VIII-9) = 18.2 fatal equivalents.

Total fatal equivalents = 116 fatalities + 32.5 nonfatal passengers +18.2 nonfatal drivers = 167 (Table VIII-11)

$129.4 million/167 = $775,204 per life saved (Table VIII-12)

Note that the low compliance cost estimate ends up being the high net cost per fatality estimate in some scenarios because of the differences in the low and high ends of the range between compliance costs and property damage savings.

Systems for drivers appear to be far less cost-effective than those for passengers, primarily because the potential safety problem for drivers is small, and because passenger-side systems have potential for property damage savings.

Table VIII-1
Compliance Costs - Per Vehicle

Ref. #	TEST-SYSTEMS	Passenger		Driver		Combined	
		Low	High	Low	High	Low	High
1	Suppression w/ Child Presence						
a	-Weight Sensor	$20.50	$24.45				
b	-Presence Sensor	$41.15	$60.90				
2	Low Risk Deployment						
a	- modified fold patterns/inflators	NA	NA	$0.00	$0.00	$0.00	$0.00
b	- Multi-stage inflators	$3.60	$21.15	$1.50	$19.65	$5.10	$40.80
3	22 - 35 mph Offset Barrier Test						
a	- added sensors and structure	$1.25	$8.40	$1.25	$8.40	$2.50	$16.80
b	- Multi-stage inflators + structure	$4.85	$22.40	$2.75	$20.90	$7.60	$43.30
4	25 mph Offset Barrier Test						
a	- added sensors	$0.00	$7.15	$0.00	$7.15	$0.00	$14.30
b	- Multi-stage inflators	$3.60	$21.15	$1.50	$19.65	$5.10	$40.80
5	Frontal Barrier Test, 5th female						
a	- modified fold patterns/inflators	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
b	- Multi-stage inflator	$3.60	$21.15	$1.50	$19.65	$5.10	$40.80
6	Frontal Barrier Test, 50th male						
a	-modified fold patterns	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	COMPLIANCE SCENARIOS:*						
	ALT#1, Compliance Option #1	$20.50	$104.75	$0.00	$19.65	$20.50	$124.40
4,5,6	Offset and Frontal Barrier Tests	1a+4a	1a+1b+4b**	2a+4a	2b+4b		
2	Low Risk Deployment - Driver	+5a+6a**	+5b+6a***	+5a+6a	+5b+6a***		
1	Suppression - Passengers						
	ALT#1, Compliance Option #2	$24.10	$45.60	$0.00	$19.65	$24.10	$65.25
4,5,6	Offset and Frontal Barrier Tests	1a+2b+4a	1a+2b+4b	2a+4a	2b+4b		
2	Low Risk Depl. - Driver & Pass.	+5a+6a	+5b+6a***	+5a+6a	+5b+6a***		
1	Suppression - Infant						
	ALT#2, Compliance Option #1	$21.75	$106.00	$1.25	$20.90	$23.00	$126.90
3,4,5,6	Offset and Frontal Barrier Tests	1a+3a	1a+1b+3b**	2a+3a	2b+3b		
2	Low Risk Deployment - Driver	+4a+5a+6a**	+4b+5b+6a***	+4a+5a+6a	+4b+5b+6a***		
1	Suppression - Passengers						
	ALT#2, Compliance Option #2	$25.35	$46.85	$1.25	$20.90	$26.60	$67.75
3,4,5,6	Offset and Frontal Barrier Tests	1a+2b+3a	1a+2b+3b	2a+3a	2b+3b		
2	Low Risk Depl. - Driver & Pass.	+4a+5a+6a	+4b+5b+6a***	+4a+5a+6a	+4b+5b+6a***		
1	Suppression - Infant						

* High and Low estimates represent maximum range of costs.

** $1.75 deducted to reflect double counting of suppression ability and telltale light in weight and proximity sensors.

*** Multi-stage inflators provide compliance for two tests. Therefore only a single system is counted. Also, multi-stage inflators in 2b, 3b, 4b, and 5b include sensor systems in 3a and 4a. Sensor costs are only counted once, but structure is not deducted when its included in sensor costs.

Table VIII-2
Present Discounted Value of Property Damage Savings (7% RATE) - Per Vehicle

Ref. #	TEST-SYSTEMS	Passenger		Driver		Combined	
		Low	High	Low	High	Low	High
1	Suppression w/ Child Presence						
a	-Weight Sensor	$12.15	$84.80				
b	-Presence Sensor	$12.15	$84.80				
2	Low Risk Deployment						
a	- modified fold patterns/inflators	NA	NA	$0.00	$0.00	$0.00	$0.00
b	- Multi-stage inflators	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
3	22 - 35 mph Offset Barrier Test						
a	- added sensors and structure	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
b	- Multi-stage inflators + structure	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
4	25 mph Offset Barrier Test						
a	- added sensors	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
b	- Multi-stage inflators	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
5	Frontal Barrier Test, 5th female						
a	- modified fold patterns/inflators	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
b	- Multi-stage inflator	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
6	Frontal Barrier Test, 50th male						
a	-modified fold patterns	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	COMPLIANCE SCENARIOS:*						
	ALT#1, Compliance Option #1	$12.15	$84.80	$0.00	$0.00	$12.15	$84.80
4,5,6	Offset and Frontal Barrier Tests	1a+4a	1a+1b+4b**	2a+4a	2b+4b		
2	Low Risk Deployment - Driver	+5a+6a**	+5b+6a***	+5a+6a	+5b+6a***		
1	Suppression - Passengers						
	ALT#1, Compliance Option #2	$12.15	$84.80	$0.00	$0.00	$12.15	$84.80
4,5,6	Offset and Frontal Barrier Tests	1a+2b+4a	1a+2b+4b	2a+4a	2b+4b		
2	Low Risk Depl. - Driver & Pass.	+5a+6a	+5b+6a***	+5a+6a	+5b+6a***		
	ALT#2, Compliance Option #1	$12.15	$84.80	$0.00	$0.00	$12.15	$84.80
3,4,5,6	Offset and Frontal Barrier Tests	1a+3a	1a+1b+3b**	2a+3a	2b+3b		
2	Low Risk Deployment - Driver	+4a+5a+6a**	+4b+5b+6a***	+4a+5a+6a	+4b+5b+6a***		
1	Suppression - Infant						
	ALT#2, Compliance Option #2	$12.15	$84.80	$0.00	$0.00	$12.15	$84.80
3,4,5,6	Offset and Frontal Barrier Tests	1a+2b+3a	1a+2b+3b	2a+3a	2b+3b		
2	Low Risk Depl. - Driver & Pass.	+4a+5a+6a	+4b+5b+6a***	+4a+5a+6a	+4b+5b+6a***		
1	Suppression - Infant						

* High and Low estimates represent benefits associated with range of costs in Table VII-1.

Table VIII-3
Net Consumer Costs (Savings) - Per Vehicle

Ref. #	TEST-SYSTEMS	Passenger		Driver		Combined	
		Low	High	Low	High	Low	High
1	Suppression w/ Child Presence						
a	-Weight Sensor	$8.35	($60.35)				
b	-Presence Sensor	$29.00	($23.90)				
2	Low Risk Deployment						
a	- modified fold patterns/inflators	NA	NA	$0.00	$0.00	$0.00	$0.00
b	- Multi-stage inflators	$3.60	$21.15	$1.50	$19.65	$5.10	$40.80
3	22 - 35 mph Offset Barrier Test						
a	- added sensors and structure	$1.25	$8.40	$1.25	$8.40	$2.50	$16.80
b	- Multi-stage inflators + structure	$4.85	$22.40	$2.75	$20.90	$7.60	$43.30
4	25 mph Offset Barrier Test						
a	- added sensors	$0.00	$7.15	$0.00	$7.15	$0.00	$14.30
b	- Multi-stage inflators	$3.60	$21.15	$1.50	$19.65	$5.10	$40.80
5	Frontal Barrier Test, 5th female						
a	-modified fold patterns/inflators	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
b	- Multi-stage inflator	$3.60	$21.15	$1.50	$19.65	$5.10	$40.80
6	Frontal Barrier Test, 50th male						
a	-modified fold patterns	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	COMPLIANCE SCENARIOS:*						
	ALT#1, Compliance Option #1	$8.35	$19.95	$0.00	$19.65	$8.35	$39.60
4,5,6	Offset and Frontal Barrier Tests	1a+4a	1a+1b+4b**	2a+4a	2b+4b		
2	Low Risk Deployment - Driver	+5a+6a**	+5b+6a***	+5a+6a	+5b+6a***		
1	Suppression - Passengers						
	ALT#1, Compliance Option #2	$11.95	$(39.20)	$0.00	$19.65	$11.95	($19.55)
4,5,6	Offset and Frontal Barrier Tests	1a+2b+4a	1a+2b+4b	2a+4a	2b+4b		
2	Low Risk Depl. - Driver & Pass.	+5a+6a	+5b+6a***	+5a+6a	+5b+6a***		
1	Suppression - Infant						
	ALT#2, Compliance Option #1	$9.60	$21.20	$1.25	$20.90	$10.85	$42.10
3,4,5,6	Offset and Frontal Barrier Tests	1a+3a	1a+1b+3b**	2a+3a	2b+3b		
2	Low Risk Deployment - Driver	+4a+5a+6a**	+4b+5b+6a***	+4a+5a+6a	+4b+5b+6a***		
1	Suppression - Infant						
	ALT#2, Compliance Option #1	$13.20	$(37.95)	$1.25	$20.90	$14.45	($17.05)
3,4,5,6	Offset and Frontal Barrier Tests	1a+2b+3a	1a+2b+3b**	2a+3a	2b+3b		
2	Low Risk Deployment - Driver	+4a+5a+6a**	+4b+5b+6a***	+4a+5a+6a	+4b+5b+6a***		
1	Suppression - Infant						

*High and Low estimates represent maximum range of costs.

Table VIII-4
Total Fleet Present Discounted Value of Consumer Costs (Savings) (7% RATE)

Ref. #	TEST-SYSTEMS	Passenger		Driver		Combined	
		Low	High	Low	High	Low	High
1	Suppression w/ Child Presence						
a	-Weight Sensor	$129,425,000	$(935,425,000)				
b	-Presence Sensor	$449,500,000	$(370,450,000)				
2	Low Risk Deployment						
a	- modified fold patterns/inflators	NA	NA	$0	$0	$0	$0
b	- Multi-stage inflators	$55,800,000	$327,825,000	$23,250,000	$304,575,000	$79,050,000	$632,400,000
3	22 - 35 mph Offset Barrier Test						
a	- added sensors and structure	$19,375,000	$130,200,000	$19,375,000	$130,200,000	$38,750,000	$260,400,000
b	- Multi-stage inflators + structure	$75,175,000	$347,200,000	$42,625,000	$323,950,000	$117,800,000	$671,150,000
4	25 mph Offset Barrier Test						
a	- added sensors	$0	$110,825,000	$0	$110,825,000	$0	$221,650,000
b	- Multi-stage inflators	$55,800,000	$327,825,000	$23,250,000	$304,575,000	$79,050,000	$632,400,000
5	Frontal Barrier Test, Unbelted 5th						
a	-modified fold patterns/ inflators	$0	$0	$0	$0	$0	$0
b	- Multi-stage inflator	$55,800,000	$327,825,000	$23,250,000	$304,575,000	$79,050,000	$632,400,000
6	Frontal Barrier Test, 50th male						
a	-modified fold patterns	$0	$0	$0	$0	$0	$0
	COMPLIANCE SCENARIOS:*						
	ALT#1, Compliance Option #1	$129,425,000	$309,255,000	$0	$304,575,000	$129,425,000	$613,800,000
4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						
	ALT#1, Compliance Option #2	$185,225,000	($607,600,000)	$0	$304,575,000	$185,225,000	($303,025,000)
4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Depl. - Driver & Pass.						
1	Suppression - Infant						
	ALT#2, Compliance Option #1	$148,800,000	$328,600,000	$19,375,000	$323,950,000	$168,175,000	$652,550,000
3, 4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						
	ALT#2, Compliance Option #2	$204,600,000	($588,225,000)	$19,375,000	$323,950,000	$223,975,000	($264,275,000)
3,4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Depl.-Driver & Pass.						
1	Suppression - Infant						

*High and Low estimates represent benefits associated with range of costs in Table VII-1.

Table VIII-5
Lives Saved

Ref. #	TEST-SYSTEMS	Passenger		Driver		Combined	
		Low	High	Low	High	Low	High
1	Suppression w/ Child Presence						
a	-Weight Sensor	91	91				
b	-Presence Sensor	91	112				
2	Low Risk Deployment						
a	- modified fold patterns/inflators	NA	NA	21	21	21	21
b	- Multi-stage inflators	132	134	39	39	171	173
3	22 - 35 mph Offset Barrier Test						
a	- added sensors and structure	12	20	67	67	79	87
b	- Multi-stage inflators + structure	137	147	79	79	216	226
4	25 mph Offset Barrier Test						
a	- added sensors	5	13	49	49	54	62
b	- Multi-stage inflators	134	144	66	66	200	210
5	Frontal Barrier Test, 5th female						
a	- modified fold patterns/inflators	2	2	14	14	16	16
b	- Multi-stage inflator	134	136	53	53	187	189
6	Frontal Barrier Test, 50th male						
a	-modified fold patterns	0	0	0	0	0	0
	COMPLIANCE SCENARIOS:*						
	ALT#1, Compliance Option #1	98	146	63	80	161	226
4,5,6	Offset and Frontal Barrier Tests	1a+4a	1a+1b+4b	2a+4a	2b+4b		
2	Low Risk Deployment - Driver	+5a+6a**	+5b+6a**	+5a+6a	+5b+6a		
1	Suppression - Passengers						
	ALT#1, Compliance Option #2	136	146	63	80	199	226
4,5,6	Offset and Frontal Barrier Tests	1a+2b+4a	1a+2b+4b	2a+4a	2b+4b		
2	Low Risk Depl. - Driver & Pass.	+5a+6a	+5b+6a***	+5a+6a	+5b+6a***		
1	Suppression - Infant						
	ALT#2, Compliance Option #1	104	148	72	84	176	232
3,4,5,6	Offset and Frontal Barrier Tests	1a+3a	1a+1b+3b**	2a+3a	2b+3b		
2	Low Risk Depl. - Driver	4a+5a+6a**	+4b+5b+6a***	+4a+5a+6a	+4b+5b+6a***		
1	Suppression - Passenger						
	ALT#2, Compliance Option #2	138	148	72	84	210	232
3,4,5,6	Offset and Frontal Barrier Tests	1a+2b+3a	1a+2b+3b	2a+3a	2b+3b		

2	Low Risk Dep1. - Driver & Pass.	+4a+5a+6a	+4b+5b+6a***	+4a+5a+6a	+4b+5b+6a***		
1	Suppression - Infant						

Table VIII-6
Present Discounted Value of Lives Saved (7% RATE)

Ref. #	TEST-SYSTEMS	Passenger		Driver		Combined	
		Low	High	Low	High	Low	High
1	Suppression w/ Child Presence						
a	-Weight Sensor	66	66				
b	-Presence Sensor	66	81				
2	Low Risk Deployment						
a	- modified fold patterns/inflators	NA	NA	15	15	15	15
b	- Multi-stage inflators	95	37	28	28	123	125
3	22 - 35 mph Offset Barrier Test						
a	- added sensors and structure	9	14	48	48	57	63
b	- Multi-stage inflators + structure	99	106	57	57	156	163
4	25 mph Offset Barrier Test						
a	- added sensors	4	9	35	35	39	45
b	- Multi-stage inflators	97	104	48	48	144	152
5	Frontal Barrier Test, 5th female						
a	- modified fold patterns/inflators	1	1	10	10	12	12
b	- Multi-stage inflator	97	98	38	38	135	136
6	Frontal Barrier Test, 50th male						
a	-modified fold patterns	0	0	0	0	0	0
	COMPLIANCE SCENARIOS:*						
	ALT#1, Compliance Option #1	71	105	45	58	116	163
4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						
	ALT#1, Compliance Option #2	98	105	45	58	144	163
4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Depl. - Driver & Pass.						
1	Suppression - Infant						
	ALT#2, Compliance Option #1	75	107	52	61	127	167
3,4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						
	ALT#2, Compliance Option #2	100	107	52	61	152	167

4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						

Table VIII-7
Nonfatal Injuries Prevented

Ref. #	TEST-SYSTEMS	Passenger		Driver		Combined	
		Low	High	Low	High	Low	High
1	Suppression w/ Child Presence						
a	-Weight Sensor	149	149				
b	-Presence Sensor	149	189				
2	Low Risk Deployment						
a	- modified fold patterns/inflators	NA	NA	20	20	20	20
b	- Multi-stage inflators	200	212	33	33	233	245
3	22 - 35 mph Offset Barrier Test						
a	- added sensors and structure	119	248	185	185	304	433
b	- Multi-stage inflators + structure	311	452	193	193	504	645
4	25 mph Offset Barrier Test						
a	- added sensors	100	229	127	127	227	356
b	- Multi-stage inflators	296	437	138	138	434	575
5	Frontal Barrier Test, 5th female						
a	- modified fold patterns/inflators	18	18	91	91	109	109
b	- Multi-stage inflator	218	230	124	124	342	354
6	Frontal Barrier Test, 50th male						
a	-modified fold patterns	6	17	0	0	6	17
	COMPLIANCE SCENARIOS:*						
	ALT#1, Compliance Option #1	273	472	218	229	491	701
4,5,6	Offset and Frontal Barrier Tests	1a+4a	1a+1b+4b	2a+4a	2b+4b		
2	Low Risk Deployment - Driver	+5a+6a**	+5b+6a**	+5a+6a	+5b+6a		
1	Suppression - Passengers						
	ALT#1, Compliance Option #2	320	472	218	229	538	701
4,5,6	Offset and Frontal Barrier Tests	1a+2b+4a	1a+2b+4b	2a+4a	2b+4b		
2	Low Risk Depl. - Driver & Pass.	+5a+6a	+5b+6a***	+5a+6a	+5b+6a***		
1	Suppression - Infant						
	ALT#2, Compliance Option #1	278	462	237	245	515	707
3,4,5,6	Offset and Frontal Barrier Tests	1a+3a	1a+1b+3b**	2a+3a	2b+3b		
2	Low Risk Deployment - Driver	+4a+5a+6a**	+4b+5b+6a***	+4a+5a+6a	+4b+5b+6a***		
1	Suppression - Passengers						
	ALT#2, Compliance Option #2	321	462	237	245	558	707
3,4,5,6	Offset and Frontal Barrier Tests	1a+2b+3a	1a+2b+3b	2a+3a	2b+3b		
2	Low Risk Depl. - Driver & Pass.	+4a+5a+6a	+4b+5b+6a***	+4a+5a+6a	+4b+5b+6a***		
1	Suppression - Infant						

Table VIII-8
Present Discounted Value of Nonfatal Injuries
Prevented (7% Rate)

Ref. #	TEST-SYSTEMS	Passenger		Driver		Combined	
		Low	High	Low	High	Low	High
1	Suppression w/ Child Presence	108	108				
a	-Weight Sensor	108	136				
b	-Presence Sensor						
3	Low Risk Deployment						
a	- modified fold patterns/inflators	NA	NA	14	14	14	14
b	- Multi-stage inflators	144	153	24	24	168	177
4	22 - 35 mph Offset Barrier Test						
a	- added sensors and structure	86	179	133	133	219	312
b	- Multi-stage inflators + structure	224	326	139	139	364	465
5	25 mph Offset Barrier Test						
a	- added sensors	72	165	92	92	164	257
b	- Multi-stage inflators	214	315	100	100	313	415
6	Frontal Barrier Test, 5th female						
a	- modified fold patterns/inflators	13	13	66	66	79	79
b	- Multi-stage inflator	157	166	89	89	247	255
7	Frontal Barrier Test, 50th male						
a	-modified fold patterns	4	12	0	0	4	12
	COMPLIANCE SCENARIOS:*						
	ALT#1, Compliance Option #1	197	341	157	165	354	506
4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						
	ALT#1, Compliance Option #2	231	341	157	165	388	506
4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Depl. - Driver & Pass.						
1	Suppression - Infant						
	ALT#2, Compliance Option #1	201	333	171	177	372	510
3,4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						
	ALT#2, Compliance Option #2	232	333	171	177	403	510
3,4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Infant						

Table VIII-9
Calculation of Cost Per Equivalent Fatality and Weighted Fatal Equivalents

Injury Severity	Comp. Value	Property Damage	Travel Delay	Revised Comp. Value	Relative	1994 PR Incidence	MAIS 2-5 Distribution	MAIS 3-5 Distribution	MAIS 2-5/Fatality	MAIS 3-5/Fatality
MAIS1	10840	3263	203	7374	0.0026					
MAIS2	133700	3356	203	130141	0.0457	335465	65.09%		0.03	
MAIS3	472290	5771	203	466316	0.1639	155961	30.26%	86.70%	0.05	0.14
MAIS4	1193860	8346	202	1185312	0.4166	17008	3.30%	9.46%	0.01	0.04
MAIS5	2509310	8018	203	2501089	0.8791	6914	1.34%	3.84%	0.01	0.03
Fatal	2854500	9138	453	2844909	1.0000					
						515348	100.00%	100.00%	0.10	0.22
						179883				

	Precent Injuries from At-Risk Group				Average Weighted Fatal Equivalents			
	Passenger		Drivers		Passenger		Driver	
	Low	High	Low	High	Low	High	Low	High
ALT1 OPT1	54.58%	45.13%	10.09%	14.41%	0.1652	0.1547	0.1161	0.1208
ALT1 OPT2	63.13%	45.13%	10.09%	14.41%	0.1746	0.1547	0.1161	0.1208
ALT2 OPT1	56.47%	46.10%	10.55%	13.47%	0.1673	0.1558	0.1166	0.1198
ALT2 OPT2	62.93%	46.10%	10.55%	13.47%	0.1744	0.1558	0.1166	0.1198

Table VIII-10
Equivalent Fatalities from Nonfatal Injuries
(Discounted @ 7%)

		Passenger		Driver		Combined	
COMPLIANCE SCENARIOS*		**Low**	**High**	**Low**	**High**	**Low**	**High**
	ALT#1, Compliance Option #1	33	53	18	20	51	73
4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						
	ALT#1, Compliance Option #2	40	53	18	20	59	73
4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Depl. - Driver & Pass.						
1	Suppression - Infant						
	ALT#2, Compliance Option #1	34	52	20	21	54	73
3,4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						
	ALT#2, Compliance Option #2	40	52	20	21	60	73
3,4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						

Table VIII-11
Total Equivalent Fatalities
(Discounted @ 7%)

COMPLIANCE SCENARIOS*		Passenger		Driver		Combined	
		Low	High	Low	High	Low	High
	ALT#1, Compliance Option #1	103	158	64	78	167	236
4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						
	ALT#1, Compliance Option #2	138	158	64	78	202	236
4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Depl. - Driver & Pass.						
1	Suppression - Infant						
	ALT#2, Compliance Option #1	109	159	72	82	181	241
3,4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						
	ALT#2, Compliance Option #2	140	159	72	82	212	241
3,4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver & Passenger						
1	Suppression - Infant						

Table VIII-12
Net Cost (Savings) Per Equivalent Fatality

		Passenger		Driver		Combined	
COMPLIANCE SCENARIOS*		**Low**	**High**	**Low**	**High**	**Low**	**High**
	ALT#1, Compliance Option #1	$1,253,589	$1,956,631	$0	$3,920,527	$775,204	$2,603,862
4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						
	ALT#1, Compliance Option #2	$1,337,939	($3,844,609)	$0	$3,920,527	$916,261	($1,285,493)
4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Depl. - Driver & Pass.						
1	Suppression - Infant						
	ALT#2, Compliance Option #1	$1,370,312	$2,070,242	$269,533	$3,961,010	$931,862	$2,713,191
3,4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver						
1	Suppression - Passengers						
	ALT#2, Compliance Option #2	$1,461,853	($3,705,928)	$269,533	$3,961,010	$1,057,269	($1,098,810)
3,4,5,6	Offset and Frontal Barrier Tests						
2	Low Risk Deployment - Driver & Passenger						
1	Suppression - Infant						